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e-Bulletin

The Great Lakes Forestry Centre (GLFC)

GLFC launches webinar series

Overview

On November 15, 2011 the Great Lakes Forestry Centre (GLFC) will launch a seminar series using webinar technology. During these hour-long seminars GLFC researchers will elaborate on their current work and answer live or submitted questions from participants across the country. Webinars will cover subjects of current interest to the forest sector, such as climate change and wildland fire, invasive forest pest management, biodiversity research, and forest sustainability. The webinar format will allow participants to take part wherever they have a telephone and internet connection. Subscribers to this e-Bulletin will automatically be notified about the upcoming seminar topic and given the registration information.

GLFC has been running a seminar series for many decades, with researchers giving presentations to a live, in-house audience. In 2010 GLFC, in collaboration with the Canadian Institute of Forestry, developed 7 electronic lectures that were broadcast nationally via teleconference (audio only). Unsolicited feedback from key clients confirmed that these e-lectures were an effective vehicle for communicating our science and allowing clients to interact with scientists, and that GLFC should continue to broadcast its seminars.

Building on the success of the e-lecture series, GLFC is initiating a webinar series. The series will be supported by new audio equipment and access to webcasting software offering full presentation control by the speaker. Webcasting can be a useful tool for many science topics of broad interest, and will allow the researchers to reach out to a broader audience in a more interactive way.

The topics and presenters are currently being finalized for the fall and winter webinars. Subscribers to this e-Bulletin will automatically receive notices and registration information. Participants from across the country or elsewhere will be able to access the webinars using a telephone and internet connection.

For more information please contact GLFC - glfc.ebulletin@nrcan.gc.ca

Bioacoustic monitoring supports wildlife research

Overview

Researcher Lisa Venier, and her colleagues at the Great Lakes Forestry Centre (GLFC) and the Ontario Ministry of Natural Resources (OMNR), has been exploring the use of bioacoustical equipment and recognition software to monitor and research wildlife populations. This cost-effective technology has the potential to significantly improve the accuracy of data collection while increasing the ability to collect larger amounts of information during the short field season in Canada. Ultimately, NRCan scientists are adapting this technology as a means to support efforts to achieve sustainable forest management and to understand the potential effects of climate change.

Monitoring of bird and amphibian populations typically involves the use of trained observers who rely primarily on auditory cues to record individuals. In recent years, GLFC and OMNR have been using remote bioacoustic recorders to monitor wildlife populations and research. Remote bioacoustic monitoring is the use of acoustic recording equipment that is placed in suitable habitats to record calls or songs that are later collected and analysed.

Lisa Venier is working in conjunction with fellow NRCan/CFS researcher Steve Holmes and OMNR researchers Glen Brown, George Holborn, Dean Phoenix and Neil Dawson on research related to bioacoustic monitoring of wildlife in remote places of Northern Ontario.

One aspect of this work is bioacoustic monitoring of song birds. Identifying birds by sound is a unique skill that few individuals possess. In the recent past, assessing song bird populations could only be done by these individuals, who were often volunteers. One of the challenges with collecting information on bird populations is the difficulty of getting skilled individuals to collect the information in the short summer breeding season, which is about 6 weeks long, especially in areas where access is difficult, such as Northern Ontario.

Bioacoustical technology allows an inexperienced technician to set up these devices in the forest to record bird songs and bring the recordings back to the office for analysis. Although there are several alternative recorders commercially available, Venier has found that Song Meters™, developed by Wildlife Acoustics Incorporated are an affordable and viable option. The Song Meter is a small, lightweight and weather-resistant recorder that can record for up to 90 hours on a single set of batteries. This equipment can be left unattended in the forest for extended periods of time, allowing more areas to be surveyed than could be done by only using skilled individuals. These devices can be programmed to record at various times of the day to capture songs from birds that are active at different parts of the day and night.

Following the breeding season a team of experts analyzes the song recordings from these devices to identify the species of birds. This analysis and interpretation can take many hours to perform. To improve efficiency the researchers are also using song recognition software, Song Scope™, in an effort to automate the interpretation of the song recordings. A benefit of this software will be to identify errors in the field samples and interpretation. In addition, this software may reduce the costs and time to identify the songs.

Bioacoustical monitoring will allow researchers to establish measures of detectability of certain bird species, through repeated sampling. These data will be used in various computer software applications, such as trend analysis, and habitat or distribution modelling, which will provide models of the effects of climate change and forest management on bird populations.

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Bioeconomy in forest sector revitalization

Overview

The crisis in the forest industry has stimulated interest in alternative uses for forest resources, helping companies and communities branch out from traditional forest products. The new bioeconomy may enable forest companies and entrepreneurs to capitalize on emerging markets for materials made from renewable resources, but they must continue to demonstrate that Canada's forests are being sustainably managed. To this end, Great Lakes Forestry Centre (GLFC) scientists, in collaboration with others, are leading multi-disciplinary studies of the ecological and economic impacts of forest biomass harvesting and purpose-grown biofibre plantations.

The recent decrease in global demand for newsprint, the strong Canadian dollar and the decline in North American housing construction have had significant impacts on the forest sector in Ontario and across Canada, which collectively have triggered a search for innovative and new commercial uses for forest resources. Business opportunities are emerging under the banner of a broad sector called the bioeconomy.

A bioeconomy is an economy where the basic building blocks for industry and the raw materials for energy are derived from plant sources. Many products traditionally made from fossil fuels can be produced from renewable forest resources including fuels, plastics, foods, pharmaceuticals and nutraceuticals. Wood-based bioenergy is especially attractive because it has the potential to simultaneously address issues of energy sustainability, climate change, forest sector revitalization, and rural economic development, without the negative consequences associated with fossil fuels or food-based fuels.

The bioeconomy is expected to enable the forest sector to expand into new markets and may change the way forest resources are managed, particularly with respect to biofibre use. Global and domestic markets often seek assurance that Canadian forest products are harvested sustainably. In Ontario, sustainability of biofibre harvesting is governed by a broad legislative and policy framework and guided by adaptive management principles, which take into account the latest science-based information. Forest biofibre is defined in Ontario's Forest Biofibre Allocation and Use Directive as all tree tops, cull trees or portions thereof, unmerchantable trees, and salvage trees. In support of the sustainable use of biofibre scientists at GLFC are informing such legislation and policies through new and ongoing research projects.

GLFC scientists Rob Fleming, Paul Hazlett, Lisa Venier, Isabelle Aubin and Kara Webster, and Ontario Ministry of Natural Resources (OMNR) scientist Dave Morris, are investigating the sustainability of intensive forest biomass removals on a range of boreal jack pine and black spruce sites. At the newly established Island Lake Biomass Harvest Research and Demonstration Area near Chapleau they are using innovative methodologies and conceptual advances to investigate interactions between harvest intensity and biodiversity, soil nutrition, vegetation composition and site productivity. For instance, the biodiversity component

uses a new conceptual approach that examines the impact of harvest level on groups of organisms and their functional traits at different trophic levels. Overall, the goal is to develop robust indicators of ecosystem function and to determine how productivity and diversity are affected by silvicultural treatments (e.g., planted species selection and vegetation control). Major project partners include the OMNR, the Northeast Superior Forest Community, the Northeast Superior Regional Chiefs Forum, Tembec Inc., the Ministry of Northern Development, Mines and Forestry, and Ontario Power Generation.

Suzanne Wetzel (Canadian Wood Fibre Centre) is leading the Petawawa Operational Biomass trial and, together with Trevor Jones (OMNR), the Algoma Biofibre Initiative Both of these studies examine the impacts of biomass harvesting within the Great Lakes-St. Lawrence forest as part of the Eastern Ontario Hardwood Initiative. A major goal of these initiatives is to test biomass harvesting as a means of carrying out stand improvement activities. Using careful logging, low-value trees are removed to improve growing conditions for higher-value species. Research is focused on determining the best value for the harvested biomass and on applying appropriate silviculture to ensure the desired outcome for trees that remain on site. This work will be continued at a new white pine mixedwood research site being established at the Petawawa Research Forest and in the Algoma Forest. Major collaborators include FPInnovations, the University of Toronto Faculty of Forestry, St. Marys Renewable Energy Corp. and OMNR.

Researchers at GLFC are also investigating ecological and economic impacts of many other forestry issues, from alien invasive species to new forest products, using spatial bioeconomic models. For example, changing prices can affect attitudes toward potential land uses, such as establishing purpose-grown biofibre crops on marginal agricultural lands. Several studies have revealed the spatial patterns of potential short rotation plantation yields and profitability for biofibre and co-products such as carbon credits. This work is led by a multi-disciplinary group including Dan McKenney, Denys Yemshanov, Darren Allen, John Pedlar, Kathy Campbell, Kevin Lawrence, Pia Papadopol and Marty Siltanen.

Results from these research activities will help to improve our knowledge of the economic and environmental impacts of biofibre harvesting. In addition to collaboration on research projects, experts from Natural Resources Canada, the OMNR and the Ontario Ministry of Northern Development, Mines and Forestry are working together to identify and consider options to address the most relevant science and policy needs of Canada and Ontario. In 2009 the three agencies formed a Bioeconomy Technical Working Group (under the Canada-Ontario Memorandum of Understanding Concerning Cooperation in Forestry), consisting of research scientists and forest policy specialists. One output of the group is an article published recently in the Forestry Chronicle entitled "Opportunities and challenges for Ontario's forest bioeconomy".

There are many opportunities for the bioeconomy in Ontario because of the unique combination of existing forest resource industrial capacity, infrastructure and forest management expertise. Transformation of the forest sector may be accelerated through new legislation (Bill 151) passed in Ontario that will modernize the forest tenure system. In addition, the Ontario Green Energy Act (2009) was designed to stimulate new growth in the development of renewable energy, including biomass-derived energy.

The bioeconomy may provide the forest sector with a viable alternative to traditional forest products, opening new market opportunities to help revitalize Canada's and Ontario's industry.

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Global Early Warning System for Wildland Fire

Overview

The Global Early Warning System for Wildland Fire is a new tool that can be used by the international community to forecast extreme fire danger conditions and to plan cooperative suppression activities. Great Lakes Forestry Centre (GLFC) fire scientists Bill de Groot and Tim Lynham led the development of this system (launched in June 2011) with the assistance of GLFC computer programmer Alan Cantin and a team of international collaborators. Fire activity has increased over the last 30–40 years and this trend is expected to continue. Fire managers will need to continue to work together at a global scale to protect communities from the social, environmental and economic impacts of disaster fires.

The Canadian Forest Fire Danger Rating System (CFFDRS), which was developed by Natural Resources Canada, Canadian Forest Service (CFS) has become a valuable tool for predicting fire hazard in Canada and elsewhere. The Canadian Forest Fire Weather Index (FWI) System, a sub-system of the CFFDRS, is the most widely used system around the world to predict fire danger. The FWI System uses weather conditions to predict the likelihood of ignition and provides an estimate of the degree of difficulty in controlling forest fires. Disaster fires (those that overwhelm fire suppression capacity and jeopardize human life, property and livelihood) occur virtually every year somewhere in the world, and many years have seen multiple disaster fires. Early warnings of extreme fire danger conditions based on the CFFDRS can provide fire managers with time to implement action plans, thus minimizing the occurrence and impact of disaster fires.

Climate change, rural to urban population shifts and land use changes all affect vegetation and fuel conditions in the forest. The global wildland fire community recognizes that no individual country has the capacity to solve the problem of increasing fire activity and disaster fire occurrence on its own, and that greater international cooperation is required to facilitate the sharing of knowledge, expertise and suppression resources.

To address this global challenge and to take full advantage of existing knowledge and expertise, fire, weather and remote sensing scientists from several continents, after many years of collaborative work, developed the Global Early Warning System for Wildland Fire (Global EWS-Fire). Launched online in June 2011, the Global EWS-Fire is an operational tool that will help minimize the impacts of disaster fires by allowing local fire management agencies to prepare and coordinate fire prevention, detection and suppression activities in advance.

Collaborating international agencies include:

- Global Observation of Forest Cover and Global Observation of Landcover Dynamics (GOFC-GOLD) – Fire Implementation Team
- Global Fire Monitoring Centre
- University of Maryland
- National Oceanic and Atmospheric Administration
- European Commission's Joint Research Centre
- International Tropical Timber Organization
- Group on Earth Observations

The CFS has a vast storehouse of expertise related to forest fire danger rating. GLFC fire scientists Bill de Groot and Tim Lynham led the development of the Global EWS-Fire as key members of the Fire Implementation Team. As project leader, Bill de Groot brought to the team the internationally accepted Canadian Forest Fire Weather Index System, a subsystem of the CFFDRS, which now serves as the common metric for the Global EWS-Fire. Tim Lynham provided the fire and remote sensing expertise to guide the system design for use with current and future earth observation data. Alan Cantin led the programming and GIS applications of the system.

GLFC staff completed the bulk of the work on the Global EWS-Fire, including developing, designing, programming, modeling and knowledge exchange tasks. The Global EWS-Fire incorporates a real-time world fire map that depicts fire hazard conditions up to 1 week in advance based on sophisticated forecast weather models. It is a web-based tool managed by GLFC staff and uses weather parameters such as humidity, temperature, precipitation and wind speed to provide updated daily fire danger ratings. In future, the system will provide forecasts up to 2 weeks in advance and will be linked to additional remote sensing data such as hotspots and area burned.

For countries that already have a fire danger rating system in place, the Global EWS-Fire will provide long range warning information. And for countries that do not have a national fire danger rating system, the Global EWS-Fire provides daily and long range early warnings using weather data collected by the World Meteorological Organization. Satellite and remote sensing data will allow for enhanced early warning products as the technologies evolve and further research is performed. As the system becomes implemented at regional and national levels, fire managers will be given technical training in using the system and in making resource allocations based on predicted fire risk through technology transfer workshops.

Many countries have expressed interest in using the Global EWS-Fire including those with well-established danger rating systems, such as New Zealand and South Africa, and others with limited experience, such as Thailand and the United Kingdom. Some countries intend to use the Global EWS-Fire to develop regionally calibrated systems for areas such as Central America, the Southern African Development Community, Europe and northern Africa, and Southeast Asia, which has been using the Canadian FWI System since 2004 and want to include the early warning capacity. Countries that do not have a national system in place (such as Argentina and Mongolia) want to use the Global EWS-Fire for that purpose.

The Global EWS-Fire provides international wildland fire management organizations with the necessary information to make timely and informed resource-sharing decisions. Resource sharing between countries can help to protect communities from the social, economic and environmental impacts of disaster fires. The Global EWS-Fire is a valuable new tool for the international community and it reinforces the reputation of NRCan/CFS as a world leader in forest fire research and management.

For more information, please refer to Frontline Express Bulletin 46. **http://cfs.nrcan.gc.ca/publications?id=32346**

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Understanding emerald ash borer at the genetic level

Overview

The emerald ash borer continues to spread across Ontario and Quebec, resulting in the loss of a significant percentage of ash species in forests and cities. At the Great Lakes Forestry Centre (GLFC) scientists are looking for ways to help slow the spread of the pest. One approach is to identify genes in the emerald ash borer that control the insect's ability to locate host trees. This novel research is the first step in the development of a possible approach to managing outbreaks of this invasive insect.

Scientists at Natural Resources Canada, Canadian Forest Service (CFS) are using biotechnology approaches in the development of target-specific pest control products for various forest insects and diseases. Biotechnology is defined as the application of science and engineering to live organisms or bioprocesses for the development of useful products. In recent years, biotechnology has made possible the sequencing and identification of thousands of genes from any organism, a discipline called genomics. Many of the genes found in insects affect insect-specific biological processes and if genes controlling these processes can be identified, then an environmentally benign solution for managing an insect might be designed.

Scientist Daniel Doucet is using genomics to study the emerald ash borer (EAB), a highly destructive alien pest that is threatening North America's ash tree population. Specifically, he is studying the mechanisms of olfaction, or how EAB detects tree volatile semiochemicals (chemicals that evoke a behavioural or physiological response in another organism) at the molecular level. Insects use olfaction as a way to find host trees, which give off volatile compounds or chemical odours. Insects also use olfaction to find mates, with males detecting pheromones given off by female insects. The highly developed antennae of insects are capable of responding to the lowest levels of odours and this response can be measured using electroantennography, a technique that measures nerve impulses that the antenna sends to the brain when the insect is exposed to a given odour. The electrical response of the antenna increases as it responds to odours of biological significance.

Chemical odour receptors in the antennae of EAB are capable of converting the odour stimulus (a chemical signal) into a nerve impulse in the sensory neurons located inside the antennae. A family of proteins called the Odorant-binding proteins (OBPs) is present in the insect antennae and plays a key role in this process. OBPs act like molecular chaperones, capturing and transporting volatile semiochemicals to odorant receptors present on the surface of the sensory neurons, which are located inside the antennae. Doucet's team is striving to identify the key OBPs in the insect that carry host tree volatiles to the neurons. Once the OBPs are known, their molecular structure can be determined. The molecular structure of an OBP can help determine with which volatile molecule it binds, and with what affinity.

The task of finding OBPs in the EAB genome is like looking for a needle in a haystack. To date, Doucet's team has found what they believe to be five OBPs from amongst 16,000 pieces of genetic material (DNA) taken from the EAB. They are now beginning to study these OBPs as part of a longer-term effort that could lead to a biocontrol strategy for EAB. For example, by identifying the molecule that binds to a given OBP, a replacement (false) volatile molecule could be designed to prevent the receptor from receiving the true molecule. In this way the insect would not be able to receive the odour signal it needs to locate a host tree, its food or its mating partner.

Understanding EAB olfaction as it is related to tree volatiles will also be useful for attracting and trapping insects. Once the tree volatiles that signal an insect to find a host tree are known, they can then be purified or synthesized and used as lures in traps. Traps are an essential tool in the early detection of new infestations, and early detection is of critical importance in managing outbreaks of invasive insect pests such as EAB.

Research conducted at GLFC will help scientists decipher how EAB navigates in a universe of odours, locates a suitable host tree, and finds mating partners and food. This information is critical for developing a complete understanding of this invasive pest's biology, and for developing better monitoring and control options. Ultimately, this research might help mitigate economic losses to the forest industry and contribute to the sustainability of Canada's forests.

For more information please contact GLFC - glfc.ebulletin@nrcan.gc.ca

Recent GLFC publications

To order copies of these publications, please contact the publications assistant email **glfc.ebulletin@nrcan.gc.ca**.

Publications are available in English unless otherwise indicated.

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